

Panel comprising a locking system

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The invention relates to a panel comprising a quadrangular panel portion of coated wood material, wherein mutually opposite edges of the panel have mutually complementary positively locking profiles so that similar panels can be assembled.

10 Panels of the general kind set forth are used for example for the production of floor coverings, so-called laminate panels. Equally panels of that kind can be designed in the form of wall or ceiling panels. Predominantly the panels comprise medium-density fibreboard (MDF) or high-density fibreboard (HDF), on to which further layers, mostly resin-
15 impregnated cellulose layers, are laminated. Frequently the positively locking profiles are provided integrally on the panels, for example by being milled thereon. In general terms the panels are of a rectangular configuration with two long edges which are in mutually opposite relationship and two short edges which are in mutually opposite
20 relationship.

The thickness of the laminate panels is generally less than the thickness of parquet panels. Usual thicknesses are in a range of between 5 and 8 mm. Thinner or thicker laminate panels are rare. It will be noted however that parquet panels have in the meantime also been provided with
25 positively locking profiles. Therefore the positively locking profiles of the proposed new panel can also be provided on parquet panels.

The complementary positively locking profiles of the one panel are restricted by the thickness of the panel and are fairly small. They therefore have to be produced very accurately in terms of shape and fit so that they
30 fit one into the other. A high degree of fitting accuracy in respect of the complementary positively locking profiles is an important requirement in order to ensure in particular a closed joint on a top side of the interlocked panels because the surface is visible to the user of a finished floor covering.

Particularly for floors it is desirable to have a smooth surface in which the joints between the panels do not form any gaps but the edges are in closely mutually butting relationship and are in contact with each other.

In the case of almost all panels with positively locking profiles, one of the complementary positively locking profiles can be viewed as an inner portion and the associated profile can be viewed as an outer portion. The relationship of an outer portion to an associated inner portion prior to the portions being joined together is referred to as the fit. Both the outer portion and also the inner portion involve given nominal dimensions, wherein tolerances are allowed for each nominal dimension. Each positively locking profile whose actual dimension is within the tolerance can be used. In accordance with a system fits are divided into three different kinds: a clearance fit, an interference fit and a transition fit. The subdivision is always based on the dimensional relationship of the outer portion with its tolerance to the inner portion with its tolerance prior to joining of the two portions.

In the case of a clearance fit the tolerances even in the worst case scenario are such that at any event after joining there is a clearance between the outer portion and the inner portion.

In the case of an interference fit the tolerances are such that at any event after the joining operation there is an overdimension between the outer portion and the inner portion and there must therefore be elastic deformation of the portions being joined.

The situation is referred to a transition fit if the tolerance ranges which are allowed for the outer portion and the inner portion partially overlap. Without knowledge of the precise actual dimensions of the outer portion and the inner portion the combination of an outer portion which is within its tolerance with an inner portion which is also within its tolerance, in the assembled condition, can give either a clearance or an overdimension or in the ideal case an exact fit which has neither clearance nor overdimension.

In order in the case of panels always to have a closed joint on the top side of the panels which is visible in the laid condition, it is known from

WO 97/47834 to provide on a positively locking profile elastic deformation which produces prestressing of the panels. By means of that prestressing, the panels are forced towards each other and in that way the joint is held in a closed condition at the top side of the panels. The panel known from WO
5 97/47834 involves a modified tongue-and-groove panel, wherein the tongue and the groove are each of an undercut configuration. The geometry of the positively locking profiles gives rise to elastic deformation at one of the groove walls, namely the lower groove wall which in the laid condition is towards the surface on which the panel is laid. The deformed
10 lower groove wall flexes like a beam which is gripped at one end. In the assembled condition of two panels flexing of the groove wall is at least partially retained. The closed nature of the joint is achieved by spring resiliency of the lower groove wall and by virtue of a particular geometry of the groove wall and the tongue, which involves the action of inclined
15 surfaces which bear against each other.

There is the disadvantage in accordance with the teaching of WO 97/47834 that the internal cohesion of the wood material is weakened by the permanent flexing effect. The higher the degree of deformation, the correspondingly 'softer' becomes the wood material in the flexurally
20 deformed region. A further disadvantage is that, in the event of a loading applied over a long period of time, relaxation of the wood material occurs in the flexurally deformed region. Absorption of moisture on the part of the wood material promotes the relaxation effect, just like an action by heat. Admittedly, positively locking profiles of panels are usually impregnated
25 with agents which are intended to prevent the absorption of moisture, but depending on the respective quality of the impregnation and the nature and location of use of the panel a gradual absorption of moisture cannot be prevented.

The object of the invention is to propose a panel whose positively
30 locking profiles are of such a configuration that panels have closed joints in the assembled condition without at the same time producing elastic deformation of a positively locking profile, such as to put a strain on wood material.

According to the invention that object is attained in that the surface of the positively locking profiles has at least in region-wise manner raised portions and recesses, that the raised portions can be ground away by friction during assembly of two panels, and that the recesses are of a
5 volume in which resulting abrasion particles from the raised portions can be received.

In the joining operation the raised portions are ground away to the required dimension. A closed joint is formed at the top side of the panel. In addition, a uniform heightwise level without heightwise displacement at the
10 joint is achieved.

Due to the action of heat, the positively locking profiles can be increased in size or they can swell up due to the action of moisture. Due to use in the specified manner, namely on a soft, footstep noise-attenuating support, in those cases grinding of the raised portions continues. That
15 provides for renewed adaptation of the fitting shape of the positively locking profiles and accordingly affords a suitable fit without overdimension and without clearance.

Desirably, one of the positively locking profiles is in the form of a groove profile with an undercut configuration and the oppositely disposed
20 positively locking profile is in the form of a tongue profile with an undercut configuration. The undercut configurations of the tongue profile and the groove profile can be fitted one into the other by virtue of inclined positioning of the panels. Subsequent pivoting of the panels into a common plane locks them. The locking effect is operative in the plane of the panels
25 to prevent them from being pulled apart in a direction perpendicular to the positively locking profiles. During the laying operation, the usual procedure is for a panel to be laid flat on a laying surface and then a new panel is attached in an inclined position to the laid panel. Pivoting the new panel into the common plane is effected by lowering it on to the laying surface.
30 The undercut configurations of the groove profile and the tongue profile engage behind each other. In that way the panels are locked together.

If the effect of grinding away the raised portions by the joining operation is not sufficient, that is to say if too little material is ground away

by the joining movement of pivoting a fresh panel downwardly into the plane of the lying panel, the positively locking profiles are ground together by a subsequent reciprocating pivotal movement until fitting accuracy in respect of the groove profile and the tongue profile is achieved. For that purpose it is also helpful if the panels are pivotably connected together, that is to say if the tongue profile is mounted similarly to a connecting joint member in the groove profile which forms a kind of pivoting joint socket. In that way the panels can be pivoted out of an angular position of -180° relative to each other both in the positive direction and also in the negative direction. The pivotal mobility permits a particularly good reciprocating grinding movement. Before the panels are definitively laid on the laying surface, they can be loosely assembled for example on a table to ascertain the required degree of grinding so as to achieve fitting accuracy. During the laying operation, fitting accuracy can be checked at the respective free end of the laid panel surface because it is there that the connection of the positively locking profiles is visible from the side. It is possible to look closely to investigate whether deformation of the positively locking profiles has occurred. For objective investigation as to whether the situation involves such deformation, it is possible for example to take a measurement of the total thickness of the locked panels in the region of the connected positively locking profiles. If the total thickness exceeds a predetermined limit dimension the grinding operation has to be continued.

Preferably the raised portions and the recesses are provided on the tongue profile and the groove profile has a smooth surface. The smooth surface of the groove profile is in contact with the raised portions of the tongue profile in the condition in which the panels are assembled in positively locking relationship. Desirably the raised portions and recesses are arranged at an underside of the tongue profile which is towards a surface on which the panels are laid. In that way the shape of the profile is adapted to the desired function. Because a panel is joined by inclinedly attaching a tongue profile to the groove profile of a panel lying on a laying surface, the construction makes use of that joining movement for grinding away and adapting the raised portions. Both in the case of the subject-

matter of claim 1 and also in the case of the development with raised portions and recesses at an underside of the tongue, adaptation of the fitting dimensions and the fitting shape of the positively locking profiles takes place during the assembly procedure. In the condition prior to joining
5 for example the positively locking profile with the raised portions has a 'surplus' of material. In relation to the complementary positively locking profile, there is an overdimension prior to the joining procedure. During the joining procedure material is ground away from the raised portions and the overdimension is removed. In that case the result is a connection in which
10 there is neither an overdimension nor a clearance. Rather, that provides for exact adaptation of the positively locking profiles, which ensures a closed joint. The stiffness of the positively locking profiles as well as the abrasion resistance of the raised portions are desirably so matched to each other that forces which occur during the assembly operation can admittedly
15 provide for abrasion removal of the raised portions, but not elastic deformation of the positively locking profiles.

The raised portions and recesses on the positively locking profile or profiles can be in the form of a microstructure which is incorporated into the surface of the positively locking profiles.

20 A further advantage is afforded by a sealing and lubricating agent which is provided at least in the recesses. Assembly of the panels by a rotating joining movement is made easier by the lubricant effect.

In addition the raised portions on the positively locking profile can be better ground away by virtue of the wetting action, than in the dry
25 condition. In the dry condition the raised portions can break off. Such breakage is prevented by the lubrication effect.

The grindability of the raised portions depends substantially on the shape thereof. A broad raised portion is less at risk of breaking off during the assembly procedure than a narrow raised portion. In the case of a
30 narrow raised portion however there is desirably less material which has to be ground away for the purposes of an accurate fit. Together with a lubricating agent, narrow raised portions have proven to be desirable

because simple adaptation is possible without the raised portions breaking off.

The invention is illustrated by way of example hereinafter in a drawing and described in detail with reference to the Figures in which:

5 Figure 1 shows a view of portions of complementary positively locking profiles of two panels prior to the joining operation,

Figure 2 shows the beginning of a joining operation for the positively locking profiles of Figure 1,

10 Figure 3 shows a joining operation which is advanced in relation to Figure 2,

Figure 4 shows a portion-wise enlargement of two locked positively locking profiles,

Figure 5 shows two positively locking profiles in a hingedly pivoted condition, and

15 Figure 6 shows the positively locking profiles of Figure 5 with lubricant.

Figure 1 shows a view of a portion of two panels 1 and 2 comprising a coated panel portion of wood material. Each of the panels 1 and 2 has at mutually opposite sides positively locking profiles which are milled integrally on the panel portion or portions. The positively locking profiles involve a
20 groove profile 3 of an undercut configuration and a tongue profile 4 of an undercut configuration. Each of the panels 1 and 2 has a respective complementary profile at mutually opposite edges. The panel 1 is thus provided at the edge in opposite relationship to its groove profile 3 with a complementary tongue profile and equally the panel 2 with the tongue
25 profile 4 is provided at the edge opposite to the tongue profile 4 with a complementary groove profile. The panels 1 and 2 are rectangular. These kind of complementary profiles are also provided for the other two edges of the panels. The positively locking profiles 3 and 4 are shown in Figure 1,
30 prior to being joined. The panel 1 is disposed on a laying surface V. The panels are coated. A decorative coating comprising a plurality of layers is arranged at a top side A of each of the panels, being the side which is away

from the laying surface V in the laid condition. An underside B which is in opposite relationship to the top side is provided with a counteraction layer.

The tongue profile 4 of the panel 2 has a tongue underside 4a with raised portions 5, 6 and 7 and recesses 8 and 9. The tongue underside 4a
5 faces towards the laying surface V in the assembled condition of the panels 1 and 2. The groove profile 3 of the panel 1, towards the laying surface V, has a lower groove wall 10 and an upper groove wall 11. The lower groove wall 10 has a channel-shaped receiving means 10a on its inward side. The channel-shaped receiving means 10a receives the tongue underside 4a of
10 the panel 1 in the assembled condition.

The channel-shaped receiving means 10a is provided with a concavely curved surface which is without raised portions and recesses. The complementary configuration of the positively locking profiles relates to the basic shapes of the groove profile 3 as an outer portion and the tongue
15 profile 4 as an inner portion which fit one into the other. The raised portions 5, 6 and 7 and the recesses 8 and 9 at the tongue underside 4a are not in the form of a negative shape in the channel-shaped receiving means 10a of the groove profile. In spite of those differences between the positively locking profiles 3 and 4, they are referred to in accordance with the
20 invention as complementary positively locking profiles.

The free end of the groove wall 10 projects from the edge of the panel 1 further than the upper groove wall 11. The free end of the upper groove wall 11 projects from the edge of the panel approximately as far as the lowest point of the channel-shaped receiving means 10a. The lowest
25 point of the channel-shaped receiving means 10a is that point which is at the smallest spacing relative to the underside B of the panel 1, perpendicularly to the plane of the panel. On its inside the upper groove wall 11 has a bevel 11a. The bevel means that the thickness of the upper groove wall decreases from the free end thereof towards the bottom of the
30 groove 3.

Prior to the operation of joining the positively locking profiles 3 and 4 the raised portions 5, 6 and 7 shown in Figure 1 at the tongue underside 4a

of the tongue profile 4 involve an overdimension in relation to the shape and dimensions of the groove profile 3.

In the assembled condition, the connection of the tongue profile 4 to the groove profile 3 of the panel 1 forms a hinge joint G. The hinge joint G
 5 permits an angular movement of the panels 1 and 2 relative to each other. In a basic position the panels 1 and 2 are at an angle of 180° relative to each other. The panels 1 and 2 can be pivoted out of that basic position both into a position involving an angle of greater than 180° relative to each other and also into a position involving an angle of less than 180° . A
 10 position of the panels 1 and 2 at an angle of greater than 180° relative to each other is described hereinafter with reference to Figure 5.

Figure 2 shows how the positively locking profiles are joined together by engaging one into the other. A panel 1 is lying on the laying surface 4 and is disposed with its groove profile 3 facing towards a new panel 2. The
 15 new panel 2 is inserted with its tongue profile 4 into the groove profile 3 of the lying panel 1, in which case the new panel 2 is set in an inclined position or is angled with respect to the lying panel 1. As illustrated a first raised portion 5 of the tongue underside 4a of the panel 2 comes into contact with the lower groove wall 10 of the groove profile 3. When that
 20 happens the tip of the raised portion 5 rubs against the surface of the channel-shaped receiving means 10a and is ground away thereat. Abrasion particles 5a which are produced pass into the recess 8 and are entrained therein during the further joining movement.

Figure 3 shows the joining operation in a further stage. A second
 25 raised portion 6 has come into contact with the surface of the channel-shaped recess 10a and is ground away thereat. Abrasion particles 6a which are produced are stored in the recess 9 which is arranged behind the second recess 6 in the joining direction of the tongue profile 4. In that way the shape of the tongue profile 4 is adapted to the shape of the groove
 30 profile 3 during the assembly procedure.

The finished assembled condition of the positively locking profiles 3 and 4 is shown in Figure 4. In that case a third raised portion 7 has also come into contact with the surface of the channel-shaped recess 10a of the

groove wall 10 and has been ground away thereat. Abrasion particles 7a which are produced in that situation are disposed in an intermediate space between the lower groove wall 10 of the groove profile 3 and the tongue profile 4. A closed joint F is produced at the top side A of the panels, which is away from the laying surface V. The joint F is formed by an end face 11b of the upper groove wall 11 of the groove profile 3 and by a contact face 12 which is provided on the tongue profile 4 and which extends from the tongue top side 4b to the surface of the panel 2. In that condition the end face 11b bears without pressure against the contact face 12. The inner portion - tongue profile 4 - of the panel 2 fits without clearance into the outer portion - groove profile 3 - of the adjacent panel 1. Elastic deformation which strains the positively locking profile does not occur.

The particularity of the structure is that the relationship of the fitting shapes of the positively locking profiles to be joined changes during the assembly procedure. In the present embodiment the fitting shape of the tongue profile 4 is matched to that of the groove profile 3. Alternatively however it is also possible for the groove profile to be provided with raised portions and recesses which grind each other away. It is immaterial in terms of the function of the connection, at what location adaptation takes place by virtue of material being ground away. The number of raised portions is not fixed at three. It is possible for example to provide a microstructure comprising a plurality of raised portions which are substantially smaller than those of the described embodiment.

Prior to the joining operation there is a 'surplus' of material in the region of the raised portions 5, 6 and 7 of the tongue profile 4. That overdimension is ground away during the assembly procedure for the positively locking profiles until the fitting shape of the inner portion is adapted to that of the outer portion.

For that purpose the stiffness of the positively locking profiles 3 and 4 and the abrasion resistance of the raised portions 5, 6 and 7 are so matched to each other that forces which occur during the assembly procedure can admittedly cause the raised portions 5, 6 and 7 to be rubbed

away, but they cannot give rise to elastic deformation of the positively locking profiles 3 and 4 respectively.

If the degree to which the raised portions 5, 6 and 7 are ground away by the joining operation is not sufficient, that is to say, if too little
5 material is ground away by the joining movement involving pivotal movement of the panel 2 down into the plane of the lying panel 1, then the positively locking profiles 3 and 4 must be ground in against each other until fitting accuracy is achieved, by a subsequent reciprocating pivotal movement. For that purpose it is extremely helpful if the panels 1 and 2 are
10 hingedly connected and can be pivoted from an angular position of 180° relative to each other both in the positive direction and also in the negative direction. The pivot joint G and the mobility thereof are indicated in Figure 5 in which the panels 1 and 2 are at an angle relative to each other which is larger than 180° . That permits a particularly good reciprocating grinding
15 movement. Prior to the panels 1 and 2 being definitively laid on the laying surface V, they can be for example loosely assembled on a table in order to ascertain the extent to which they have to be ground in against each other so as to achieve fitting accuracy. During the laying operation, fitting accuracy can be checked at the respective free end of the locked panel
20 surface. There, the connection between the positively locking profiles 3 and 4 is visible from the side. It is possible to examine the arrangement to ascertain whether deformation of the positively locking profiles 3 and 4 has occurred. For the purpose of objectively checking whether deformation is present, it is possible for example to take a measurement of the total
25 thickness of the panels 1 and 2 in the region of the joined positively locking profiles 3 and 4. If the total thickness exceeds a predetermined limit dimension the grinding-in operation has to be continued.

Figure 6 shows an embodiment of panels 1 and 2 whose positively locking profiles 3 and 4 are treated with a so-called insulating wax. This
30 involves an agent which provides lubrication for the joining movement of the positively locking profiles 3 and 4. In addition the insulating wax is squeezed into free intermediate spaces 13a, 13b and 13c within the locked positively locking profiles 3 and 4 and is pressed for example in the form of

a thin film into the joint F at the top side of the panels 1 and 2. In that way the insulating wax acts as a sealing agent. The sealing agent is applied in an amount which at least partially covers the surface of the positively locking profiles. That prevents the ingress of moisture into the joint F and thus into the wood material. Otherwise the wood material would swell due to the absorption of moisture. The amount of insulating wax can fill up the intermediate spaces 13a, 13b and 13c or can be of a somewhat smaller quantity so that free spaces remain. In addition its lubricating property provides that creaking or grating noises do not occur in the region of the positively locking profiles 3 and 4 of the panels 1 and 2 because a lubricant film is formed. Creaking or grating noises occur in the case of panels 1 and 2 when a relative movement takes place between the positively locking profiles 3 and 4. That is the case for example when laying floor panels on a flexible, footstep sound-damping support, because the panels 1 and 2 sink into the flexible support when loaded at the connecting location.

List of references

1	panel
2	panel
3	groove profile
4	tongue profile
4a	tongue underside
4b	tongue top side
5	raised portion
5a	abrasion particle
6	raised portion
6a	abrasion particle
7	raised portion
7a	abrasion particle
8	recess
9	recess
10	groove wall
10a	channel-shaped recess
11	groove wall
11a	bevel
11b	end face
12	contact face
13a	intermediate space
13b	intermediate space
13c	intermediate space
A	top side
B	underside
F	joint
G	pivot joint
V	laying surface